

LCA Policies

Life-Cycle Based Government Policies

A Survey

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Abstract

This paper examines how different Life-Cycle Assessment (LCA) approaches, from full LCA's to more qualitative LCA's, are being used internationally in the development of government policies. Examples from 14 countries are provided for recent initiatives in various forms of policy which were developed to move national environmental policies toward the more life-cycle based programs. They indicate that a broader frame of reference is beginning to be used by those who write such policies. Discussion is also provided on the barriers that slow the adoption of life-cycle approaches in the development of government policies.

Keywords: Life-cycle assessment; life-cycle approach; life-cycle concept; eco-balance; environmental policy; product labelling; waste management

1 Introduction

During recent years many private companies have begun to integrate pollution prevention into their activities and management systems. However, a similar integration within government in the development of policies and regulations has been slower to come about. Measures taken by government authorities in the area of environmental protection have focused mainly on selected environmental concerns, such as impacts to the air, water, or soil, as well as on single life-cycle stages, such as production or waste management. Such narrow solutions run the risk of simply transferring impacts to another stage in the life cycle or resulting in little or no overall beneficial effect. There is a growing realization for the need to consider incorporating life-cycle impacts in the strategic planning and development of government policies and regulations.

A search of the open literature revealed both positive and negative experiences across 14 countries in using such approaches. By presenting various international examples, this paper describes the current status of the application of life-cycle approaches in the development of government policies and regulations. The information that is presented is from a paper which was written in May 1996 as part of the Masters program at the International Institute for Industrial Environmental Economics at Lund University, Sweden. The main results and conclusions from that paper are reproduced here. Details of the activities that have oc-

curred across the different government offices are provided in the full paper [1].

2 The Life-Cycle Approach vs LCA

The idea of devising a shortened LCA approach that is less costly and less time-consuming than a full LCA has much appeal and has led to a lot of discussion on what is meant when one says that a life-cycle approach was followed [2]. The meanings for the various terms that are being used to describe different approaches to LCA, such as streamlined LCA, life-cycle thinking, life-cycle approach, etc., are still to be defined, and limits are needed to determine when an assessment has strayed beyond the meaning of the life-cycle concept, no longer qualifying as an LCA. However, according to TODD (1996), there seems to be basic agreement on what a life-cycle based project should include. Mainly, any life-cycle approach must recognize all the life-cycle stages in a system (for a product, process or activity) encompassing raw material acquisition, material processing, production, use, reuse, recycling and final disposal. The study should include some form of inventory, and may also include impacts assessment. The study should clearly define the boundaries and method used for the study. And, finally, the study should yield results that are consistent with those produced by a full LCA [3].

Experts at a recent workshop in Hankø, Norway, on the "Application of LCA" concluded that whenever the authorities are involved in decisions on issues that may influence the environment, at a minimum a life-cycle approach should be applied. This decision-making process would include other appropriate information such as cost, cost-benefit analysis (CBA), risk assessment, environmental impact assessment (EIA), and others. For some decisions, life-cycle approaches can help support policy development and implementation, although a full LCA is not always required in developing policy and regulation. The level of detail should be consistent with the policy objectives and the scope of the study [4].

This paper looks at both life-cycle approaches and LCA's and how they are being implemented in the development of government policy. The use of a life-cycle approach can help ensure that changes result in movement in a positive

direction by helping decision-makers focus their efforts to achieve the greatest environmental advantage.

3 Application to Government Decision-Making

A distinction has been made here between the different applications of government policies so that they are described as being oriented toward products, waste management, or processes.

Product-Oriented Policy: This category mainly involves eco-labeling and procurement programs. Such programs attempt to identify those products which are relatively less harmful to the environment than others. This can only be done if the criteria are based on an overall assessment of the product's life cycle.

Waste Management Policy: Waste management has basically been concerned with packaging and recycling issues. Typically, the information is used to base decisions on whether specific materials should be recycled (vs landfilling, incineration, etc.) and establishing recycling rate targets. These programs are vulnerable to the same caution that applies to the product-oriented policies, that is a life-cycle approach would likely lead to a more informed and broad-based policy.

Process-Oriented Policy: Policies that do not fit neatly into the other two categories are considered here to be process-oriented. By and large, the area of interest is in how policy makers are using life-cycle approaches to write policies that go beyond a traditional focus, such as end-of-pipe control or single media options, to a more holistic view. There are fewer examples in this area than the other two.

Many product and packaging policies have given the appearance of beginning to move away from such traditionally narrow views to the broader life-cycle concept. However, full integration has not always been accomplished even where it has been stated that a life-cycle view was taken in preparing the policy. Of necessity, they all examine the product life cycle but then focus on a few particularly important environmental aspects (such as the heavy metal content of a battery or the recycled content of a paper product).

Thus, although eco-labels are more comprehensive than the so-called single-issue labels, such as "recyclable," "biodegradable," or "non-toxic," they do not necessarily reflect an integrated LCA of relative environmental quality [5, 6]. Hence, the practice of establishing objective criteria for evaluating product categories does not always include the entire life-cycle of environmental impacts associated with products. In most of the criteria that have been developed, only a limited number of aspects of the product's life cycle impacts are considered.

This situation is changing, but only slightly. Attempts are being made in some programs to base eco-labels on life-cycle inventory data. Also, discussions are being held in the ISO 14,000 subcommittee on environmental labeling for what is called Type III (information disclosure) labeling.

4 Activities in Different Countries

Recently, the international experience with the application of life-cycle methods for policy development has increased significantly. Today examples can be found in several countries which demonstrate a growing interest in integrating the life-cycle concept into different types of policies. Activities in European, North American, Australian and Japanese government offices, across 14 countries, are presented in Table 1.

Table 1: Experiences with using the Life Cycle Concept in government policies

	Type of Policy		
	Product	Waste Management	Processes
Australia	+ Procurement - Eco-Label		
Austria	+ Eco-Label		
New Zealand	+ Eco-Label		
Belgium		? Eco-Tax & PVC Packaging	
Canada	+ Eco-Label	+ Packaging Waste Reduction	+ Toxic Substance Management
Denmark	? Eco-Label		
France	+ Eco-Label	+ Packaging Waste Management	+ Tax on CO ₂ Emissions
Germany	+ Eco-Label	+ Waste Management Targets	
Japan	+ Product Policy + Eco-Label		
The Netherlands	+ Eco-Label ? Manufacturing	- Packaging Waste Management	+ Metals & Chlorine Ban
Norway	? CO ₂ Tax on Oil	? Tax on Soft Drink Packaging	
Sweden	+ Producer Responsibility	+ Waste Reduction Targets	
United Kingdom	+ Eco-Label		
United States	? Procurement	? Used Oil	? Alternative Fuels -Solvents Standard

+ = policy developed based on life-cycle information
- = no policy developed after consideration of LCA
? = under consideration

Table 1 summarizes both the applications of the 14 countries which were found as well the overall experience indicated in using the life cycle concept in developing government policies. These are described with a positive or negative sign to indicate if a policy was developed using some form of life-cycle information, or by a "?" to indicate that a final decision has not yet been reached on how the results are to be used.

4.1 Product-oriented policies

By far, the most common application of life cycle thinking is in the development of product-oriented policy, with the majority in eco-labeling programs (8 of the 14 countries studied have eco-labels). This may be attributable mainly to integration of LCA ideas into several EU regulations, including the Eco-Label Council Regulations (880/92/EEC), the Packaging Directive Proposal [COM(93)419 final-

SYN 436], and the Eco-Audit Council Regulation (1836/93/EEC). [7]. The experiences with product-oriented policy in Europe so far include what can be called voluntary information instruments which encompass environment-related product information underlying certain rules and standardized criteria, including life-cycle approaches. According to IÖW, the EU does not plan to formulate proposals for directives or recommendations requiring the use of LCA's. According to SCHOLL, although the words "life-cycle assessment" do not appear in the EU regulations, a life-cycle approach is the most appropriate within this context [8].

While Australia's experience with life-cycle based procurement has been positive, their attempt to develop an eco-label is the only negative one reported and resulted in the cancellation of the program. This is not to say that no other negative experiences have occurred. They were just not reported in the literature. Another 5 countries have used life cycle approaches in various applications including general product policy (Japan), manufacturing policy (The Netherlands), taxation (Norway), producer responsibility (Sweden), and procurement (US).

- Japan enacted "The Basic Environmental Law" which integrates the former Basic Pollution Control Law, the Nature Conservation Law and related acts. This new law provides national policy principles toward the creation of a sustainable society with less. The government recognizes that the Life Cycle management of products plays a key role in effectively implementing their product policies, although the methodology is still under development and requires further investigation for practical application [9].
- The Dutch government is considering legislation to require different companies associated with a specific product system to provide data and environmental information for every stage in an item's manufacture [10].
- The Norwegian State Pollution Authority commissioned a study to consider two CO₂-taxation regimes on energy recovery of used lubricant oil. The screening LCA study shows that there will be an environmental benefit for re-refining used lubricant oil over energy recovery as is performed today. The authorities are considering the results [4].
- Sweden's environmental policy, established in its 1993 "Eco-Cycle Bill," requires all decisions to be directed toward efficient management and to promote an "eco-cycle" society with closed-circuit material flows. Ordinances passed in August and September 1994 require producers to take responsibility after use for packaging, newspapers, and tires [10].
- In the US, guidance is being developed by the EPA to meet the 1993 Executive Order 12873, entitled "Federal Acquisition, Recycling and Waste Prevention." The proposed guidance encourages the adoption of a life cycle approach in determining environmentally preferable products. This concept is being tested out through various pilot projects on specific product categories. How and the extent to which this can be done practically within a complex acquisition process remains to be seen" [4].

4.2 Waste management policies

The waste management policies include various applications for packaging and general waste material management approaches. Most commonly, the activities that were found in this category were for setting waste reduction targets and goals. In The Netherlands, a detailed LCA was carried out in 1994 to compare five options for managing plastic household wastes. While LCA was found to be useful in lifting the debate on packaging to a higher level, answering many questions, it leaves other questions unanswered. They were unable to develop a life-cycle based policy, however, it is reported that many other insights were gained which go beyond the main issue.

Also, the Belgium and Norwegian governments have programs in which life-cycle information is being considered to set taxes on packaging, and the effort in the US Department of Defense is re-evaluating their policy of re-refining used oil. The discussion is on-going within DoD and it is not yet possible to say if an LCA-based policy will change current procedures [4].

4.3 Process-oriented policies

The applications under this category vary substantially and cover 5 topics: toxic substance management (Canada), taxation on emissions (France), substance bans (The Netherlands), alternative fuels (US), and standards development (US).

Environment Canada's proposed Toxic Substances Management Policy proposes a life-cycle approach to assessing risk management strategies for toxic substances. The current strategy defines four criteria for classifying substances: predominantly anthropogenic, persistent, bioaccumulative, and toxic. Results of the evaluation determine if substances should be targeted for elimination or subjected to life-cycle management, mainly through tools such as risk assessment and risk management. The assessments of substances on the Priority Substances List have already been performed. Strategies to reduce or eliminate the risk from these substances are being developed [11].

Also in Canada, a 1993 policy document, entitled "A National Commitment to Pollution Prevention," includes a set of principles and actions to minimize or avoid the creation of pollutants and wastes. One of the principles states that "prevention should apply to the entire life-cycle of a product, from resource extraction to final disposal." To this end, Environment Canada developed a Federal Pollution Prevention Strategy which identifies product life-cycle management as a key component of pollution prevention [11].

A study in France on the taxation of air emissions (CO₂ emissions) was based on LCA results [9].

The Dutch parliament has been asked for a detailed overview and evaluation of the total chlorine chain in 1994 in order to pacify the chlorine discussion. A substance flow analysis, combined with an LCA, led to an impact assessment which identified the most important leaks in the chlorine chain. The industry objected to the straightforward use of LCA in this context because they found the analysis

and evaluation of toxic and ecotoxic effects were not consistent with the methodology for risk assessment, e.g., bio-accumulation and bio-degradation. The environmental groups have rejected the offer to participate in this project because they felt chlorine should be banned.

Triggered by concerns over high concentrations of certain heavy metals, LCA's have been carried out for those products or materials that are found to be the main diffuse source of the metals, e.g., zinc concentration has been shown to be too high in water. In 1994, LCA's were carried out on different materials for roof guttering and crash barriers. Policy decisions will be made based on those outcomes [4].

The US Department of Energy has instituted a policy to develop and apply LCA principles to the formulation of the nature and extent of technical and financial support for alternative fuels (energy carriers) and chemical feedstocks (derived from biomass materials). The use of the study to make recommendations for further establishment of subsidies or tax credits for the alternative fuels is on-going. Although not complete, it is clear that the use of LCA-based methodology has provided a much improved and expanded view of the implication of biomass-derived fuel [4].

A test case was initiated by the EPA's Office of Pollution Prevention and Toxics to investigate the possibility of using a life-cycle approach in developing a MACT (maximum achievable control technology) standard under the 1990 Clean Air Act. The selected MACT looked at alternative solvents used in degreasing operations. However, the study was not completed for a number of reasons. Quite apart from methodological issues, organizational and other factors, such as time constraints, weighed more heavily against the project. No new data (especially for the alternatives) could be collected given the time and resource constraints on the Air Office's program [4].

While not a success, this first attempt established a baseline of information on what is needed for consideration of an LCA approach in the regulatory development process. EPA prepared a "lessons learned" document from their experience. EPA has made a second attempt. This time the Office of Water, on their initiation, is considering life-cycle data in the development of regulations for effluent discharges from industrial laundries, focusing on shop towels that contain solvents, oil and grease [4].

5 Barriers to the Application of LCA in Developing Policy

There is little doubt among the international LCA experts about the value of using a life-cycle approach when assessing environmental strategies. But, this understanding is apparently not as widespread among the different government policy offices. Although examples are increasing, neither LCA nor life-cycle approaches have yet become familiar elements in policy making. Some common barriers that have slowed the adoption of life-cycle approaches in the development of government policies and regulations were described by the participants of the Hankø workshop on LCA Applications.

1. The lack of (inter)nationally agreed upon methods for evaluation and weighing the results of LCA's.
2. Companies' concerns with confidentiality preventing consensus building or reducing the transparency of information and hence the credibility of LCA results.
3. Decision makers, the general public, the press, etc., want LCA to be presented in a very simplified format from which an obvious "winner" emerges. These groups need to be made aware of the complexities of LCA. There is a tendency to overestimate the role of science in solving political problems.
4. A network is lacking which would make the results of LCA's available to the public and government. Information on LCA, in general, needs to be more accessible at an international level.
5. Current government policy encourages partial initiatives. Government offices can be segmented by media concerns (air, water, solid and hazardous waste) or by topical interests (raw material extraction, energy, manufacturing sectors, or disposal). Government provides little incentive for these individual offices to switch or broaden their scope of interest.
6. Existing regulations in some countries are a major disincentive for the adoption of LCA. Regulations provide penalties instead of incentives.
7. Layers in state, regional, or local governments make communication very difficult.
8. The international dimension of material and product systems forms a barrier. The government has taken limited action to support and establish forms of cooperation.
9. Short deadlines, caused by a lack of planning, set by politicians, do not allow for the time needed to conduct quality assured LCA.
10. Government offices have not adopted life cycle management systems within their operations.
11. Governments lack a framework for integrating information with other factors that must be considered in the decision-making process, such as economics and societal needs.

As stated by the Hankø workshop participants, these barriers point to the

- "immediate need to increase the awareness of LCA throughout all governments and the public. Awareness will promote shifts in attitudes to move away from structured focus."
- "An ongoing educational process is needed to inform the public and politicians of LCA, avoiding arbitrary goals established to meet perceived urgent problems and simple solutions."

These barriers also identify the need to improve access to relevant and quality data to allow for the successful application and development of LCA methodology. While life-cycle approaches require much less data than full LCA's, they still require good, quality data in order to be performed. However, the lack of such data, either through inaccessibility or unavailability, is the main barrier to the increased adoption of the life-cycle concept in policy making. Because of this pressing need, groups such as SPOLD are conducting projects to put LCA data in a generally-available database to increase the usefulness of LCA studies [12].

6 Conclusions

While it is difficult to summarize the policies of many countries, it can be said in general that most regulations up until now have been solution-oriented, often forcing companies to choose traditional end-of-pipe solutions. There even exists the possibility that the changes enforced by regulations have not resulted in an improved global environment. Government policies should promote companies to identify and realize such solutions, and not be specific in differentiating a given set of solutions.

Recently several initiatives in various forms of policy have been developed to move national environmental policies and regulations toward the more life-cycle based programs. These programs require the consideration of multiple aspects of a company's activities, including design, packaging, transportation, use and disposal. While the wording is parallel with a life-cycle framework, these programs do not require that detailed LCA's be performed. However, they indicate that a broader frame of reference is beginning to be used by those who write such policies.

Many of the national labeling programs focus only on a few environmental attributes after identifying them as the most significant ones that reflect the overall performance of products and can be used to determine environmental superiority. Examples have been provided where state governments have claimed to have looked holistically at product systems in developing packaging policies. However, comparison of impacts have perhaps not been taken into account. Often, the focus is still on the final disposal stage. Other policy writers claiming to have included life-cycle considerations seem to mean that the use and final disposal stages of a product system were studied. This does not imply that, as is the intention of an LCA, the environmental impacts were evaluated together in an integrated fashion. Until terminology is better established, any study that claims to be "life cycle" should be carefully scrutinized to be sure that a life-cycle approach to consider the sum of environmental impacts through the entire life-cycle of the product was actually used.

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